CLAIMS

What is claimed is:

1. A method for selecting non-recursive variable rate spreading codes, the method comprising:

providing a plurality of spreading code sets C_1, $C_2 \ldots C_n$, wherein providing the plurality of spreading code sets further comprises:

constructing each of the spreading code sets with at least one spreading factor (SF) level, wherein each SF level corresponds to a spreading factor $2^j SF_{min}$, for $j=0 \ldots z$, where z is a predetermined integer;

assigning to each of the at least one SF levels in each of the spreading code sets C_1, $C_2 \ldots C_n$, a matrix node corresponding to $N_2{}^j$ for $j=0 \ldots z$, where the z has been predetermined; and

selecting one of the plurality of spreading code sets C_1, $C_2 \ldots C_n$.

2. A method as in claim 1 wherein assigning the matrix node corresponding to $N_2{}^j$ for $j=0 \ldots z$, where the z has been predetermined further comprises:

assigning each node $N_2{}^j$ on each SF level within each set C_1, $C_2 \ldots C_n$ a plurality of indices, wherein each of the indices comprises:

a base code spreading vector matrix index; and

a modulation spreading vector index.

3. A method as in claim 2 wherein the base code spreading vector matrix index comprises a sub-base code matrix index.

4. A method as in claim 1 wherein selecting one of the plurality of symmetrical spreading code sets C_1, $C_2 \ldots C_n$ further comprises:

assigning each code sets C_1, $C_2 \ldots C_n$ at least one dwell time t_1, t_2, t_n, respectively; and

selecting each sets C_1, $C_2 \ldots C_n$ for the duration of its associated dwell time t_1, t_2, t_n.

5. A method as in claim 4 wherein assigning each code sets C_1, $C_2 \ldots C_n$ at least one dwell time t_1, t_2, t_n, respectively, further comprises assigning t_1, t_2, t_n substantially equal dwell times.

6. A method as in claim 5 wherein assigning t_1, t_2, t_n equal dwell times further comprises assigning t_1, t_2, t_n dwell times substantially equal to a symbol period associated with the at least one SF level $2^j SF_{min}$, for $j=0$.

7. A method as in claim 4 wherein assigning each code sets C_1, $C_2 \ldots C_n$ at least one dwell time t_1, t_2, t_n, respectively, further comprises pseudo-randomly assigning t_1, t_2, t_n dwell times wherein each dwell time is an

integer multiple of a symbol period associated with the at least one SF level 2^jSF_{min}, for j=0.

8. A method as in claim 7 wherein pseudo-randomly assigning t_1, t_2, t_n dwell times wherein each dwell time is an integer multiple of a symbol period associated with the at least one SF level 2^jSF_{min}, for j=0 further comprises pseudo-randomly constructing t_1, t_2, t_n dwell times, wherein each dwell time is an integer multiple of a symbol period associated with the at least one SF level 2^jSF_{min}, for j=0.

9. A method as in claim 4 wherein assigning each code sets C_1, $C_2 \ldots C_n$ at least one dwell time t_1, t_2, t_n, respectively, further comprises assigning t_1, t_2, t_n dwell times wherein each dwell time is an integer multiple of a symbol period associated with the at least one SF level 2^jSF_{min}, for j=0.

10. A non-recursive method for constructing orthogonal PN code sets for use in a code division, multiple access (CDMA) communication system, comprising:

forming a first modulation matrix M^1, wherein the first modulation matrix M^1 comprises at least one modulation vector $M_{1 \ldots k}$, where k is predetermined;

forming a first base-code matrix C, wherein the first base-code matrix C comprises sub-base code matrices C^r, where $r \geq 2$; and

forming PN code sets:

$\ldots\ C^{1}{}_{i,:}\ M_{j,1}\ C^{2}{}_{i,:}\ M_{j,2}\ \ldots\ C^{r}{}_{i,:}\ M_{j,r}\ C^{1}{}_{i,:}\ M_{j,r+1}\ \ldots\ C^{w}{}_{i,:}\ M_{j,k}$ $C^{w+1}{}_{i,:}\ M_{i,1}\ \ldots,$

where i = i^{th} row;

: = all columns within i^{th} row; and

k > r.

11. A method as in claim 10, wherein forming the first modulation matrix M^1 further comprises providing P modified-Hadamard matrices G_i^P with dimension $2^{(B-1)}SF_{min}$ x $2^{(B-1)}SF_{min}$, where P=1...B, $B=Sf_{max}/SF_{min}$.

12. A method as in claim 11 wherein providing the P modified-Hadamard matrices further comprises:

providing P Hadamard matrix(s);

permuting the rows of the P Hadamard matrix(s) according to a first predetermined formula;

permuting the columns of the P Hadamard matrix(s) according to a second predetermined formula; and

inverting a subset of the rows of the P Hadamard matrix(s) according to a third predetermined formula.

13. A method as in claim 10, wherein forming the first base-code matrix C further comprises:

providing a Hadamard matrix of dimension 2^B, where B = Sf_{max}/SF_{min};

permuting the Hadamard matrix to form base code sub-matrices $H_1...H_n$, where $n=1...2^{(B-1)}$, where $H_1...H_n$ are of dimension 2^B; and

concatenating the base code sub-matrices to form base code matrix C, where $C=[H_1|H_2|H_3]$.

14. A method as in claim 10 wherein forming the PN code sets further comprises:

grouping the PN code sets according to the sub base code sets C^r to form tree structures $T_{1...r}$;

arranging the PN code sets within each tree structure $T_{1...r}$ in a predetermined hierarchical pattern; and

assigning dwell times $D_{1...r}$ to each tree structure $T_{1...r}$.

15. A method as in claim 14 wherein assigning the dwell times $D_{1...r}$ to each tree structure $T_{1...r}$ further comprises arranging each of the dwell times $D_{1...r}$ to be equal, such that $D_1...D_n...D_r$.

16. A method as in claim 14 wherein assigning the dwell times $D_{1...r}$ to each tree structure $T_{1...r}$ further comprises:

for each dwell time $D_{1...r}$:

determining a unit time;

multiplying the unit time by a pseudo-randomly selected integer; and

assigning the dwell time to its corresponding tree structure $T_{1 \dots r}$.

17. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for selecting non-recursive variable rate spreading codes, the method comprising:

providing a plurality of spreading code sets C_1, $C_2 \dots C_n$, wherein providing the plurality of spreading code sets further comprises:

constructing each of the spreading code sets with at least one spreading factor (SF) level, wherein each SF level corresponds to a spreading factor $2^j SF_{min}$, for $j=0 \dots z$, where z is a predetermined integer;

assigning to each of the at least one SF levels in each of the spreading code sets C_1, $C_2 \dots C_n$, a matrix node corresponding to $N_2{}^j$ for $j=0 \dots z$, where the z has been predetermined; and

selecting one of the plurality of spreading code sets C_1, $C_2 \dots C_n$.

18. A program storage device as in claim 17 wherein selecting one of the plurality of symmetrical spreading code sets C_1, $C_2 \ldots C_n$ further comprises:

assigning each code set C_1, $C_2 \ldots C_n$ at least one dwell time t_1, t_2, t_n, respectively; and

selecting each set C_1, $C_2 \ldots C_n$ for the duration of its associated dwell time t_1, t_2, t_n.

19. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for constructing orthogonal PN code sets for use in a code division, multiple access (CDMA) communication system, the method comprising:

forming a first modulation matrix M^1, wherein the first modulation matrix M^1 comprises at least one modulation vector $M_{1 \ldots k}$, where k is predetermined;

forming a first base-code matrix C, wherein the first base-code matrix C comprises sub-base code matrices C^r, where $r \geq 2$; and

forming PN code sets:

$\ldots\ C^1{}_{i,:}\ M_{j,1}\ C^2{}_{i,:}\ M_{j,2}\ \ldots\ C^r{}_{i,:}\ M_{j,r}\ C^1{}_{i,:}\ M_{j,r+1}\ \ldots\ C^w{}_{i,:}\ M_{j,k}\ C^{w+1}{}_{i,:}\ M_{i,1}\ \ldots$,

where $i = i^{th}$ row;

$:$ = all columns within i^{th} row; and

$k > r$.

20. A program storage device as in claim 19 wherein forming the PN code sets further comprises:

grouping the PN code sets according to the base-code vectors C^r to form corresponding tree structures $T_{1...r}$;

arranging the PN code sets within each tree structure $T_{1...r}$ in a predetermined hierarchical pattern; and

assigning dwell times $D_{1...r}$ to each tree structure $T_{1...r}$.

21. A substantially synchronous CDMA communications system, comprising:

a radio base unit capable of bi-directional wireless multirate communications with a plurality of subscriber units, each subscriber unit having a subscriber unit data rate; and

a controller for reordering:

a Hadamard matrix by exchanging columns and rows of the first Hadamard matrix in accordance with at least one first predetermined reordering code to produce a first reordered pseudonoise (PN) code set having improved spectral properties;

at least two second Hadamard matrices by exchanging columns and rows of each of the

second Hadamard matrices in accordance with at least one second predetermined reordering code to produce at least two second reordered pseudonoise (PN) code sets;

a modulator for modulating the first reordered PN code set with each of the second PN code sets to generate at least two usable PN code sets for modulating a data signal of the subscriber units as a function of the subscriber unit data rate.

22. A system as in claim 21, wherein said modulator further comprises a code set dwell time controller for assigning dwell time to each of the at least two usable code sets for modulating the data signal.